PATENT SPECIFICATION

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(19)

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(54) NON-SPILL OPEN TOP CONTAINER

(71) I, BRENDA LAVAL HUNTER, of British nationality, of New Court, 3 Hillcrest Street, Milngavie, Dunbartonshire, Scotland, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to non-spill containers for fluent material.

The present invention is a container comprising a container body having a circular base and surrounding wall and a lid located thereover, said lid having an opening therein and being either parallel to the base or angled down from its periphery to the opening, and a peripheral collar extending from said opening towards the container base, the inner face of the lid, the collar and the side wall of the container body forming an inverted trough in the roof of the container, said collar extending to a depth whereby, on location of a predetermined amount of fluent material in the container, the contents will be retained therein if the container is tilted or inverted, said predetermined amount being substantially its volume which can be contained within the trough when the container is inverted, the dimensions of the container being such as will satisfy the expression

$$\frac{\pi}{3}\,[3(\rho+\mu)-\varpi^2(3\mu+\rho)-\rho-\varpi\rho)]\geqslant \cos^{-1}\varpi-\varpi\,\sqrt{(1-\varpi^2)}-\frac{\pi\rho}{6}(1-\varpi)^2\geqslant\frac{4}{5}\pi(1-\mu-\rho).$$

where

$$\rho=\frac{\text{height from top of lid to opening}}{\text{depth of body wall}}$$

$$\mu=\frac{\text{depth of collar}}{\text{depth of body wall}}$$

$$\varpi=\frac{\text{mean radius of collar}}{\text{radius of base}}$$

An embodiment of the present invention will now be described, by way of example with reference to the accompanying drawings, in which:—

Fig. 1 is a sectional elevation of a container according to the invention;

Figs. 2 to 4 illustrate the non-spillage qualities of the container; and

Fig. 5 is a sectional elevation of a container according to a second embodiment.

The container is particularly but not exclusively useful as a dog's drinking bowl and is described in the preferred embodiment (Figs. 1 to 4) in relation thereto.

The container, which in this embodiment is circular, includes a container body having a base 10, an upstanding surrounding wall 11, and a substantially flat lid 12 having an outer peripheral double flange 13 to form a watertight seal with the body wall 11 and a central circular opening 14 from which a peripheral collar 15 extends downwardly towards the container base. The collar may taper very slightly, e.g., 5° so that it is substantially cylindrical or by as much as 15°.

The collar 15 extends only partly into the container body and terminates before reaching the base 10.

The depth of the collar is determined from the ratio

$$\mu=\frac{z}{t}$$

where z is the depth of the collar, t is the depth of the body wall and

$$\mu=\frac{1}{3-2\varpi^2}$$

where

$$w=\frac{\text{mean radius of collar } (r)}{\text{radius of base } (R)}$$

This relationship is determined by consideration of the three positions of the bowl as shown in Figs. 2 to 4.

In Fig. 2 the bowl is shown ready for use, in Fig. 3 the bowl is shown tilted at an angle α but with an amount of water which will not spill out through the opening and Fig. 4 shows the bowl inverted and containing a maximum amount of water within the trough. If angle α in Fig. 3 is increased to 90° the maximum condition for that position is obtained and for non-spill use volume of liquid in position Fig. 4 $\geqslant$ volume of liquid in position Fig. 3 with $\alpha=90°\geqslant$ volume of liquid in position Fig. 2. Thus

$$\pi(R^2-r^2)z\geqslant t\left[R^2\cos^{-1}\frac{r}{R}-r\sqrt{(R^2-r^2)}\right]\geqslant\frac{\pi R^2}{2}(t-z)$$

substituting $\varpi=\dfrac{r}{R}$ and $\mu=\dfrac{z}{t}$

$$\pi(1-\varpi^2)\mu\geqslant\cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}\geqslant\frac{\pi}{2}(1-\mu)$$

This condition must be satisfied if the circular bowl is to be non-spill. Thus, in the limiting case when the actual volume in the bowl (Fig. 2) completely fills the available volume in the trough (Fig 4).

$$\pi(1-\varpi^2)\mu=\frac{\pi}{2}(1-\mu)$$

i.e.

$$\mu=\frac{1}{3-2\varpi^2}$$

When the dimensions of a bowl have the above relationship, the water will just be contained when the bowl is inverted. Normally, however, it is desirable for the available volume in the inverted position to be greater than the actual volume of water in the bowl, so that

$$\mu>\frac{1}{3-2\varpi^2}$$

For water not to spill out when the bowl is being turned over, the volume of water in the tilted position (Fig. 3) is greater than the volume of water in the in-use position (Fig. 2),

i.e. $\cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}>\dfrac{\pi}{2}(1-\mu)$.

Any values of ϖ and π which satisfy these above conditions will be satisfactory measurements for a non-spill circular bowl.

For example,

if $r=1.5''$ and $R=4.5''$, $\varpi=\dfrac{r}{R}=\dfrac{1}{3}$ then

$$\cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}=\frac{\pi\times70.5}{180}-\frac{2}{9}.\sqrt{2}=0.92$$

Thus $0.92>\dfrac{\pi}{2}(1-\mu)$

$$\mu>=1-\frac{0.92\times2}{\pi}$$

$$\mu>1-0.58$$

$$\mu>0.42$$

Thus, for a radii ratio of

$$\frac{1}{3},$$

(the depth of collar/depth of wall ratio must be at least 0.42.

Suitable measurements would be

$r=1.5''$ $t=3''$
$R=4.5''$ $z\geqslant1.26''$

Maximum depth of water i.e. $\frac{1}{2}(t-z)$ is 0.87". Capacity for non-spill usage 1.59 pints. (using conversion 1 cu inch = 0.288 pts).

Other dimensions which would satisfy the above requirements can be obtained in a similar manner, ϖ, R, t are independent variables whose choice can be made to satisfy physical requirements. Three examples are included in the summary table.

$w=\frac{r}{R}$	$\mu=\frac{Z}{t}$	$2r$	$2R$	z	t	$\frac{1}{2}(t-z)$	Non-spill Capacity
$\frac{1}{2}$	0.61	4.5"	9"	1.83"	3"	0.59"	1.08 pts.
$\frac{2}{5}$	0.49	3.6"	9"	1.47"	3"	0.77"	1.41 pts.
$\frac{1}{3}$	0.42	3"	9"	1.26"	3"	0.87"	1.59 pts.

Thus, a variety of bowls having a predetermined no-spill capacity could be made for different kinds and sizes of animals.

The condition

$$\mu > \frac{1}{3-2\varpi^2}$$

is satisfied for the above measurements.

Owing to the low viscosity of water, it has been found experimentally that a gap approximately $\frac{1}{2}(t-z)$ should be left between the top of the water and the lower edge of the flange, i.e., depth of water should be approximately $\frac{1}{2}(t-z)$, as indicated in the expression on page 2 line 17.

In practice, one would run water into the bowl, and invert it so that excess water ran out; the amount still remaining would then be the maximum amount to prevent spillage should the bowl be upset.

For a high viscosity fluid the depth thereof could be increased.

In a second embodiment (Fig. 5) the container illustrated is particularly, but not exclusively, suitable for containing a highly viscose material such as paint.

The container has the same component parts, namely a base 10, surrounding wall 11, lid 12, double flange seal 13, circular opening 14 and collar 15. The lid, however, has its surface sloping down to the opening. Thus, paint gathering on the lid (after a paint brush has rested on it) will drain into the container.

Due to the high viscosity of paint, the depth of paint in the container can be

$$\frac{4}{5}(t-z-h)$$

where t is the depth of the wall 11.

The same symbols are used as in the first embodiment with the addition of

h=height from top of lid to opening and

$$\rho=\frac{h}{t}.$$

The inequalities obtained with a sloping lid are:—

$$\frac{\pi}{3}\,[3(\rho+\mu)-\varpi^2(3\mu+\rho)-\rho-\varpi\rho)] \geqslant \cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}-\frac{\pi\rho}{6}(1-\varpi)^2 \geqslant \frac{4}{5}\pi(1-\mu-\rho).$$

Suitable dimensions are as follows:

$z=2.1''$ $R=0.3''$ $t=3.5''$ $r=1.35''$ $R=3.75''$

giving $\rho-0.086$
$\mu=0.60$
$\varpi=0.36$

Capacity for non-spill use 1.12 pints.

A non-spill container as hereinbefore described when used as a dog's drinking bowl permits access to the water through the central opening but will prevent spillage if the dog tilts or overturns the bowl. The bowl may be used in the home or in a car or it may even be transported containing water in a shopping basket so that an accompanying dog can be given a drink at any suitable time. The amount of water contained in a normally sized dog bowl, i.e., about $1\frac{1}{2}$ pints is considered adequate since normally it will be possible to replenish the contents within a reasonable time.

A container used to hold paint poured from a tin has the obvious advantage of preventing damage or unnecessary clearing up since if it is accidentally knocked, tilted or overturned the paint will not spill out.

It is considered that materials other than water and paint could be used, for example, granular material and that the container could be applied to industrial use as well as domes-

tic use, e.g., containing small parts for an assembly line where the container could be accidentally upset.

WHAT I CLAIM IS:—

1. A container comprising a container body having a circular base and surrounding wall and a lid located thereover, said lid having an opening therein and being either parallel to the base or angled down from its periphery to the opening and a peripheral collar extending from said opening towards the container base, the inner face of the lid, the collar and the side wall of the container body forming an inverted trough in the roof of the container, said collar extending to a depth whereby, on location of a predetermined amount of fluent material in the container, the contents will be retained therein if the container is tilted or inverted, said predetermined amount being substantially its volume which can be contained within the trough when the container is inverted, the dimensions of the container being such as will satisfy the expression

$$\frac{\pi}{3}\,[3(\rho+\mu)-\varpi^2(3\mu+\rho)-\rho-\varpi\rho)]\geqslant\cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}-\frac{\pi\rho}{6}(1-\varpi)^2\geqslant\frac{4}{5}\pi(1-\mu-\rho)$$

where

$$\rho=\frac{\text{height from top of lid to opening}}{\text{depth of body wall}}$$

$$\mu=\frac{\text{depth of collar}}{\text{depth of body wall}}$$

$$\varpi=\frac{\text{mean radius of collar}}{\text{radius of base}}$$

2. A container as claimed in Claim 1, in which the lid is parallel to the base so that $\rho=0$, and the expression is simplified to

$$\pi\,(1-\varpi^2)\mu\geqslant\cos^{-1}\varpi-\varpi\sqrt{(1-\varpi^2)}\geqslant\frac{\pi}{2}\,(1-\mu).$$

3. A container substantially as hereinbefore described, with reference to Figs. 1 to 4 or Fig. 5 of the accompanying drawings.

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HUNTER

1428356 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

FIG.1.

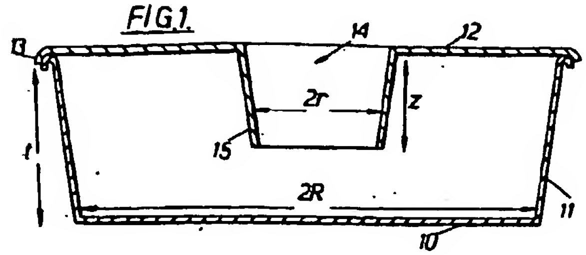

FIG.2.

FIG.3.

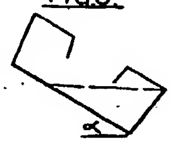

FIG.4.

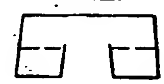

FIG.5.